Creedon is new associate administrator for Office of Aerospace Technology, see page 2

The X-PRESS

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UCAV notches first 2 flights

■ X-45 UCAV excels in 2 milestone missions

By Jay Levine
X-Press Editor

The X-45A Unmanned Combat Air Vehicle (UCAV) flew its first two missions near flawlessly in May and June. The program succeeded with Dryden support.

Since Dryden entered into an agreement with The Boeing Company and Defense Advanced Research Projects Agency (DARPA) in May 1999, the Center has provided technical expertise and a home for the UCAV X-45A Program, said Gary Cosentino, Dryden's X-45A project manager.

EC02 0106-02 NASA Photo by Jim Ross

X-45A flies during its first flight May 22. It had a successful flight on June 13 and a third flight is expected in early August.

So far, so good

"It went incredibly smoothly," Cosentino said of the first two flights. "There were no software changes (from the first flight to the second flight). We flew the same racetrack in the sky on the second flight, just with one more loop. Future flights will look at parameter identification (PIDs) maneuvers and stability and control assessments of the airplane, as we expand in altitude and Mach number, and of course, retract the gear."

First flight for the X-45A was May 22 for 14 minutes and the second flight was June 13, when the aircraft flew for 32 minutes. Both flights were successful and a third flight is set for mid August.

"These early flights will demonstrate the viability of the UCAV concept. After expanding the envelop and validating airworthiness, we will expand into demonstrations," he said.

The X-45A will demonstrate a number of firsts, including the first autonomous aircraft movements from the hangar to the sky, while integrating with manned aircraft. These first steps on the two flights permitted Dryden's talents to shine, Cosentino said.

"Dryden has played key roles. This is the first vehicle that will have a full taxi capability around manned aircraft, a taxi route to an active runway, will hold short, and just like a manned aircraft, after receiving clearance, will taxi onto the center line of the runway and take off. We looked at all of the 'what ifs' from the hangar to the manned aircraft world on and around the airfield," he explained.

The Center's responsibilities cover a number of areas.

"We support them with range support, facilities and office space. There are 25 Boeing people on site. Boeing was

See X-45, page 10

Petersen explains NASA's new plans

By Jay Levine
X-Press Editor

Center Director Kevin Petersen explained at a recent all hands meeting that NASA's Administrator Sean O'Keefe has set a new mission statement and vision for the National Aeronautics and Space Agency.

The Agency seeks to evolve and change to meet the new requirements and challenges that will be needed for new kinds of missions, Petersen said.

Kevin L. Petersen

NASA's Vision is:
To improve life here,
To extend life to there,
To find life beyond.

Understanding Earth's environmental system and responding to natural and human-induced changes, working toward a safe, secure, efficient and environmentally friendly air transportation system, are main elements of the vision.

Other parts of the vision are investing in technologies, collaborating with others to improve the quality of life and creating a more secure world and exploring the universe and life within it – first with robotic trailblazers and eventually by humans.

And to achieve new milestones, the NASA Mission is:
To understand and protect our home planet,
To explore the Universe and search for life,
To inspire the next generation of explorers as only NASA can.

See Plans, page 2

Helios Team captures a top aero award

By Jay Levine
X-Press Editor

Dryden's Environmental Research Aircraft and Sensor Technology (ERAST) and Helios Prototype Solar-Electric Sensor Team accepted the 2002 NASA Administrator's Award for Outstanding Accomplishments at the recent Turning Goals Into Reality (TGIR) Conference.

See Award, page 11

Inside

AAW rollout inspires, see page 3

Make Dryden Safer Day succeeds, see page 4

Digital Fly-By-Wire has 30th anniversary, see pages 6-7

Dryden supports Endeavour landing, departure, see Extra

Creedon selected as new Associate Administrator

Langley Research Center director accepts new challenge

■ O'Keefe selects new Aerospace Technology AA, Venneri remains Chief Technologist

By NASA News Services

Dr. Jeremiah F. Creedon, director of the NASA Langley Research Center, Hampton, Va., has been named associate administrator for the Office of Aerospace Technology at NASA Headquarters in Washington, effective June 15.

Samuel L. Venneri, who has been associate administrator for the Enterprise since February 2000, will remain at Headquarters as chief technologist, a second position he has held since 1996.

Dr. Jeremiah F. Creedon

In making the announcement, Administrator Sean O'Keefe praised the work of both men. "Sam has been effectively wearing two hats since 1996, but I felt it was time he focused on a technology strategy for the Agency. I feel fortunate that someone of Jerry's caliber was available to step up and assume the duties of associate administrator and lead our Office of Aerospace Technology."

In his new position as associate administrator, Creedon will be responsible for developing integrated, long-term, innovative agency-level technology for aeronautics and space. He will also be charged for developing new commercial partnerships that exploit technology breakthroughs, and for establishing and maintaining technology core competencies at the NASA field centers.

Creedon, who is Langley's seventh director in the Center's 85-year history, began his career there 39 years ago as an engineer. He succeeded Paul F. Holloway.

Prior to being named Center director, Creedon served as director of the Airframe Systems Program Office and director of the Aeronautics Program Group. Creedon began his NASA career at Langley in June 1963 as a research engineer in the Navigation and Guidance Research Branch, Instrument Research Division.

Creedon has a doctoral degree from the University of Rhode Island. He is the author of more than 30 technical articles and is a fellow of the American Institute of Aeronautics and Astronautics.

Before being named chief technologist, Venneri served as director of the Spacecraft Systems Division in the former Office of Space Access and Technology. He started his career at NASA in 1981 as a program manager in the Office of Aeronautics and Space Technology, where he was responsible for the spacecraft design technology, structural dynamics, computational analysis and design methodology, and aircraft and engine materials and structures technology.

Prior to joining NASA, Venneri was an aerospace consultant with Swales and Associates and principal engineer with Fairchild Space Electronics. He has a bachelor's degree from Pennsylvania State University and a master's degree in engineering from George Washington University.

"We have a variety of technology and fiscal challenges ahead of us," added Administrator O'Keefe. "Having Jerry and Sam together on the same team here in Washington will play an important role in the continued success of our aeronautics and aerospace technology efforts."

Delma C. Freeman Jr., Langley's deputy Center director, will assume duties as acting director.

Plans

... from page 1

The mission statement encourages and calls for a new spirit of cooperation with the national security community; emphasis on providing policy makers with timely information; technology and useful tools for priority issues of international importance; and a greater emphasis on transferring technologies to others.

Exploring and searching for life is another element of the mission, with decisions based on science and not destination. Scientific exploration will drive human presence in low-Earth orbit and investments will be justified on their contribution to the long-range vision.

Air and space missions that would not be completed if NASA did not do them are a focus of the final element of the new vision statement. As a part of that, activities will be integrated across the Agency as a diverse and unified team, programmatic and budget decisions will be aligned with the mission statement and new technologies will be used and the nations' industrial and intellectual capital will be leveraged.

In addition to looking at the changes in NASA, Petersen said Dryden will place high priority on two projects – the X-37 and the X-43.

The X-37 is a flight demonstrator to test Reusable Launch Vehicle (RLV) technologies for a future spacecraft.

The hypersonic X-43 is expected to fly from a Pegasus booster after the stack is air launched from underneath the wing of the NASA B-52.

Also as part of O'Keefe's new focus, Petersen said a greater emphasis will be placed on education. NASA plans to expand programs that focus on educating and motivating the next generation of students in math, science and technology.

Dryden also will change its financial management systems in conjunction with all of the NASA Centers, Petersen said. The biggest element of this change is development of a single integrated financial management system, which provides meaningful and timely financial information to internal and external customers.

The Integrated Financial Management Program (IFMP) will "provide NASA with a modern, leading edge business system that will provide compliance with external regulatory guidance; promote standardization and integration of business processes and systems across NASA; provide the management information needed for mission success; and meet the information needs of internal and external customers," according to a description on Dryden's internal IFMP Web site.

Improving performance is another goal that includes products and services, organization and safety. Safety remains the most important focus of the Center, Petersen said.

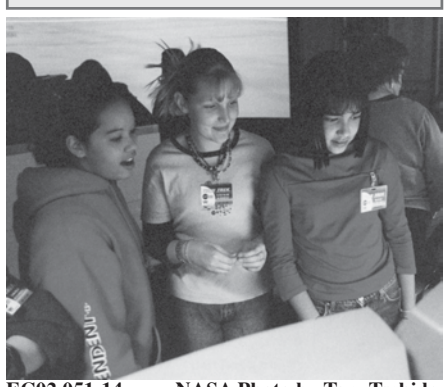
EC02 083-12 **NASA Photo by Jim Ross**

B-52 H arrives with new paint scheme

NASA's B-52H, sporting its new white and blue NASA paint scheme, returned to Dryden on April 17th.

The B-52H left Dryden early last August for demilitarization and depot maintenance at Tinker Air Force Base near Oklahoma City, Okla. The depot-level work consisted of a thorough maintenance and inspection process. Following maintenance at Tinker, the aircraft participated, along with Dryden's venerable B-52B 008, in a B-52 50th Anniversary event at McConnell Air Force Base in Wichita, Kan., on April 12.

The B-52H will be used along with B-52B 008 as an air-launch aircraft supporting NASA's flight research and advanced technology demonstration efforts.



EC02 051-14 **NASA Photo by Tom Tschida**

Scholarship finalists for the American Association of University Woman Tech Trek math and science summer camp recently visited Dryden as a reward for their work.

EC02 065-2 NASA Photo by Tony Landis

Dryden Center Director Kevin Petersen addressed the audience attending the rollout ceremonies for the Active Aeroelastic Wing (AAW) flight research project on March 27.

Back to the Future

AAW showcases wing twist – an idea that originated with the Wright brothers

By Alan Brown
Public Affairs Specialist

As the first aircraft sporting the U.S. Centennial of Flight Commission's official logo, a modified NASA F/A-18 is poised to begin an investigation of Active Aeroelastic Wing (AAW) technology – a 21st-century, high-tech twist on wing warping for flight control pioneered by the Wright brothers almost a century ago. The aircraft was displayed at Dryden rollout ceremonies in March.

The overall goal of this $41 million program is to demonstrate improved aircraft roll control through aerodynamically-induced wing twist on a full-scale manned supersonic aircraft.

AAW research could also enable thinner, higher aspect-ratio wings on future aircraft, which could result in reduced aerodynamic drag, allowing greater range or payload and improved fuel efficiency. Data obtained from flight tests at Dryden will provide benchmark design criteria as guidance for future aircraft designs.

The AAW program is a cooperative venture of the U.S. Air Force Research Laboratory, Boeing's Phantom Works and Dryden to research the use of lighter-weight flexible wings for improved maneuverability of future high-performance aircraft. The project reflects both a return to aviation's beginnings, and a gateway to the future – a future where aircraft will sense their environment, and adapt their shape to the existing flight conditions.

See AAW, page 10

EC02 065-23 NASA Photo by Tom Tschida

Maj. Gen. Doug Pearson, Air Force Flight Test Center commander, points out a feature of the Active Aerolastic Wing (AAW) to Dr. Pamela Drew, left, Boeing Phantom Works vice president for engineering and information technology, and Maj. Gen. Paul Nielsen, Air Force Research Laboratory commander.

EC02 065-54 NASA Photo by Tom Tschida

Retired aeronautics engineer Bob Hoey talked to a packed ISF crowd who came to hear him speak about his observations of birds and his flying models that mimic flight characteristics of the birds.

Learning to be safe

■ MDS summer safety and health awareness event fires up Dryden employees

By Sylvia E. Pierson
Make Dryden Safer (MDS) Program Coordinator

The MDS Committee joined forces with a number of Dryden organizations and Edwards Air Force Base (EAFB) to present an open house fair on Summer Safety and Health Awareness May 14.

The all-day event in and around the ISF complex featured a wide variety of workshops, demonstrations, and information booths.

Workshop topics included supervisor training on OSHA Requirements/ Worker's Compensation, Workplace Violence, Stress Awareness, Hearing Conservation, and Fire Warden Training. The workshops were presented in partnership with the Human Resources Management and Development Office, the Employee Assistance Program (EAP), the Dryden Health Unit and the Safety, Health and Environmental Office (Code SH).

Demonstrations on the proper use of fire extinguishers and evacuation chairs were popular with Dryden employees, as was the opportunity to view the contents of Dryden's conex boxes (locker boxes that contain disaster preparedness equipment and supplies) and to watch demonstrations of numerous evacuation equipment and tools.

"This alternative format for an MDS Day really helped employees get a close look at all of the equipment and supplies Dryden has ready to go in the event of a disaster," commented Jack Trapp, Code OC branch chief and the chair of the MDS Program. "The fair atmosphere also made the day's activities feel more casual and relaxed, a sort of 'Safety Lite' event where employees could de-stress and take in information at their own pace. Partnering between Code S and volunteers from around the Center and associating fun with safety were our goals – which I think we achieved."

As noted by Trapp, employees had the opportunity to explore information booths set up by MDS Committee partners on topics such as Heat Stress, Flightline and Hangar Safety, Disaster Preparedness, Fitness, EAP Programs, Ergonomics and the Close Call and Hazards Reporting System. Other booths included information on Health and Medical, Flight Safety and Quality Assurance, Life Support and Pilot Safety, Fire, Chemical and Water Safety, Security, the MDS Program and a special Desert Animal & Plant Safety booth staffed by the 95th Security Forces Squadron and the Environmental Management Office.

"This event helped me be more aware of things to watch out for – things I might not have thought of until they happened," said Grace Garcia, Infinity support specialist with Code FE. "I really came away with information that I could apply at home and at work – I learned about the different types of smoke detectors and carbon monoxide detectors available for home use, I saw some of the rattlesnakes that we have out in the desert, and I got to participate in the water test between water from Dryden and bottled water. I'd have to say that not only was this informative, but it was fun, too."

Sign-up opportunities for CPR/First Aid training, ergonomic evaluations, and medical gym evaluations were also available during the event, as was the opportunity to indulge in two popular summertime activities – ice cream served by members of the Dryden Exchange Council and a supervisor and manager dunk tank fundraiser.

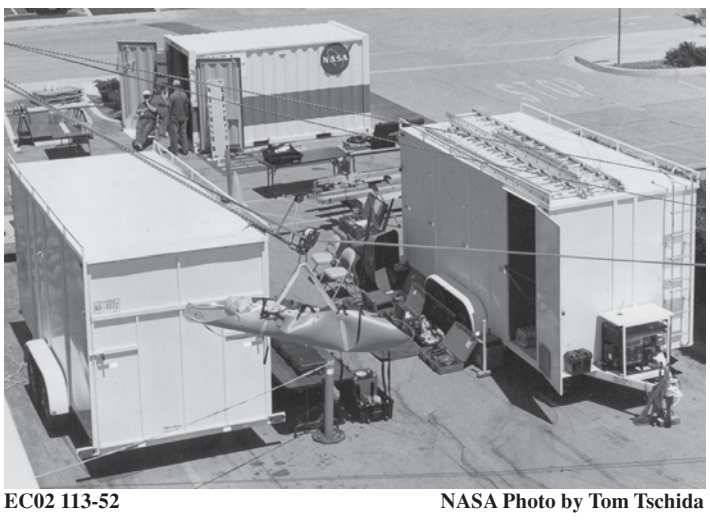
"The popularity of the supervisor and manager dunk tank activity was overwhelming," exclaimed Tom McMullen, Code OR branch chief and organizer of the MDS Day. "Crowds of people came from throughout the Center to try their hand at dunking their favorite supervisor or manager and enabled us to raise $530 for the Exchange Council and the MDS Program. It was great to see Dryden come out for this event – thanks to everyone who made it possible."

The MDS Program is an employee-based program aimed at making Dryden a safer and better place to work. The foundation of this employee-based safety program is active employee involvement and management commitment. Since its inception in 2000, MDS has worked with the Safety Office to bring Dryden employees Code-specific safety briefings, the All-Hands MDS Holiday Kickoff, and the MDS Days in January and May 2002. Employees interested in getting involved with the MDS Program are encouraged to attend MDS Committee meetings. For more information on the MDS Committee meetings, contact the MDS Resource Center at ext. 5248 or refer to the Center calendar.

EC02 113-55 NASA Photo by Tom Tschida

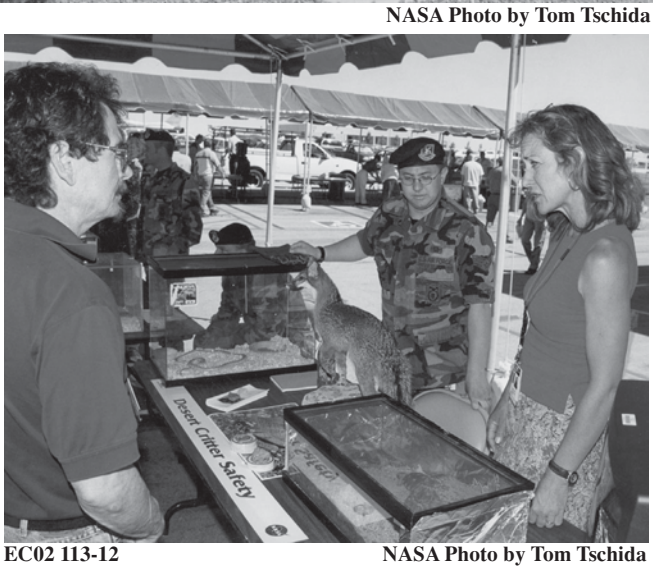
Brad Flick takes a swim courtesy of one of the dunk tank patrons. The dunk tank raised $530 for Make Dryden Safer and the Dryden Exchange Council.

EC02 113-46 NASA Photo by Tom Tschida



EC02 113-52 NASA Photo by Tom Tschida

Some of Dryden's safety equipment was displayed including a conex box that contains items needed in a disaster. Also displayed is an evacuation dummy on a sked – a plastic harness used to evacuate people from hard to reach or high places.



EC02 113-12 NASA Photo by Tom Tschida

EAFB biologist Linda Anton talks to Robby Robinson, left, about desert wildlife. Airman Joshua Clifford, center, also talked to Dryden employees about wildlife.

EC02 113-80 NASA Photo by Tony Landis

Fire Chief Bill Smith, middle, instructs Barbara Schofield, left, and Letecia Malone, right, on the proper use of fire extinguishers.

EC02 107-22 NASA Photo by Kerrie Patton

Dryden employees show support for five high school teams that competed at a regional robotics competition and came to Dryden to show what they created.

Dryden supports Robotics, looks for addional mentors

The Dryden Education Office hosted five robotics teams from area schools for an employee demonstration May 22. The student-built robots competed in a nationwide engineering design competition sponsored by the nonprofit For Inspiration and Recognition of Science and Technology (FIRST) organization.

NASA is a key partner in this effort along with corporations and other government agencies. Teams from Lancaster High School, Lancaster, Calif., South High, Bakersfield, Calif., Tehachapi High, Tehachapi, Calif., Chatsworth High, Chatsworth, Calif., and Archer School for Girls, Los Angeles, Calif., operated the robots at the Dryden event. Dryden's Tom McMullen mentored the Tehachapi Team and Dryden's Adam Matuszeski mentored the Lancaster Team.

Robotics teams are seeking mentors for next season, as are the Lego League teams, the minor league of robotics.

The competitions are sponsored by FIRST to inspire students in math, science and technology.

People interested in lending their expertise to a team as a mentor can contact Maribel Gutierrez at the Dryden Educator Resource Center at (661) 276-5828.

Beth Hagenauer, aerospace projects writer and Maribel Gutierrez, Dryden Education Office Flyer editor, contributed to this article.

Under Pressure

■ Time ticks as students construct their robots

By Adam Matuszeski
Dryden Operations Engineer

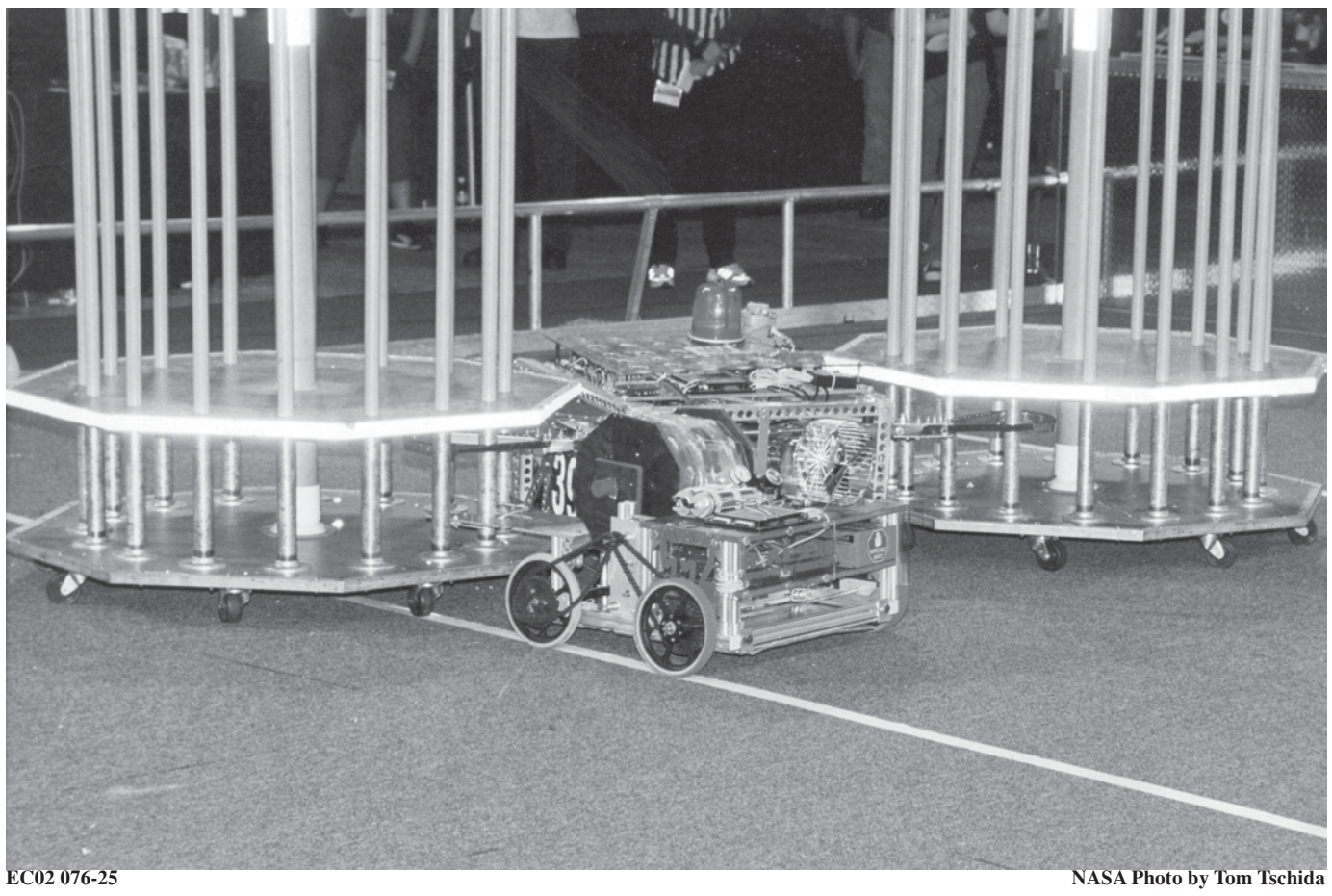
The For Inspiration and Recognition of Science and Technology (FIRST) Robotics competition is a six-week scramble to build a remote controlled robot to perform with and against other robots in a playing arena. Every year, the creators of FIRST devise a one-of-a-kind game involving moveable goals, large and small balls, teeter-totters, and whatever else might strike their fancy.

This is the second year that I have mentored the Lancaster High School Eagle Robotics Team, and each year the team has had a tougher challenge to meet and a tougher robot to meet it. For this year's metal monster, the team voted the name "Oompa-Loompa" and we tried hard to live up to that invincible image.

Having now spent two years in the Operations Engineering Design Group at Dryden, I appreciate the freedom of the robotics design process. Imagine six weeks of no requirements documents, design reviews, drawing specs, configuration change requests, work orders, or Gant charts! Nope, just a great idea and a deadline is enough to keep me coming back.

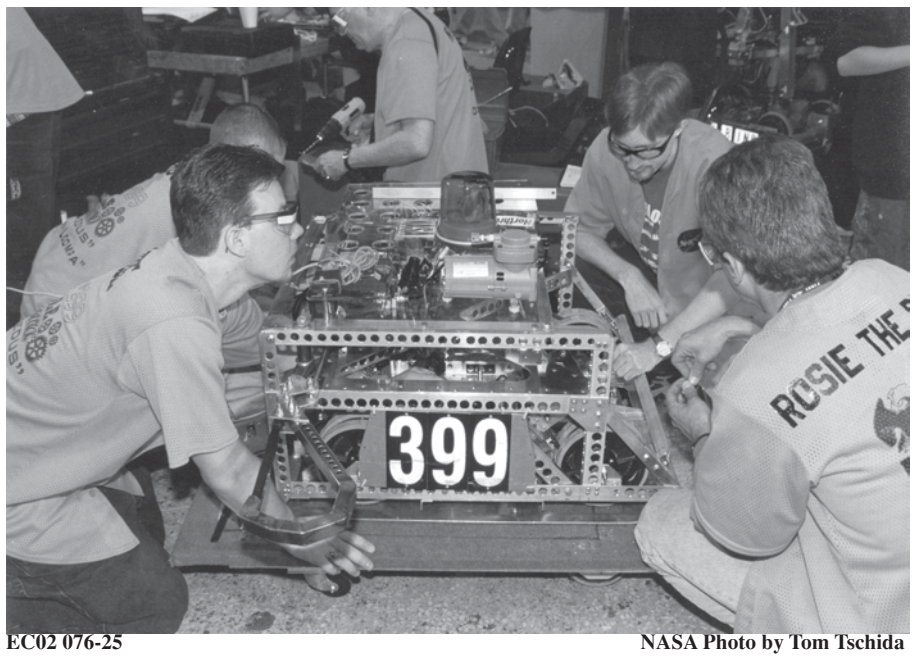
The arena, the game rules, and the bucket o' parts are all brought forth to all the teams across the country simultaneously at an event known as "Kickoff." This year "Kickoff" occurred at 6 a.m. on a Saturday morning, Jan. 5. I was not present because Saturday mornings are somewhat sacred, and as my mind is not capable of brainstorming and strategizing at such an hour.

Although some teams start frantically working at the opening bell, the Lancaster team, as I found out later, mostly went home and slept. When I showed up on Monday for the first day of the first two week period I call the Design Stage, the high school students already invoked their mantra; "You know what would be REALLY cool?!!" That was a part of the Design Stage – brainstorming. It consisted of coming up with an endless series of creative – and sometimes dangerous – ideas and that involved projectiles, pyrotechnics, and electromagnetic levitation. This is the fun part, the part where no technical feat – be it eight wheel drive or cold fusion – is beyond the capabilities of our team.



EC02 076-25 NASA Photo by Tom Tschida

Above, Lancaster High School Robotics Team's Oompa-Loompa is locked in battle. Below, Adam Matuszeski, second from right, assists the Lancaster team with a last-minute challenge.



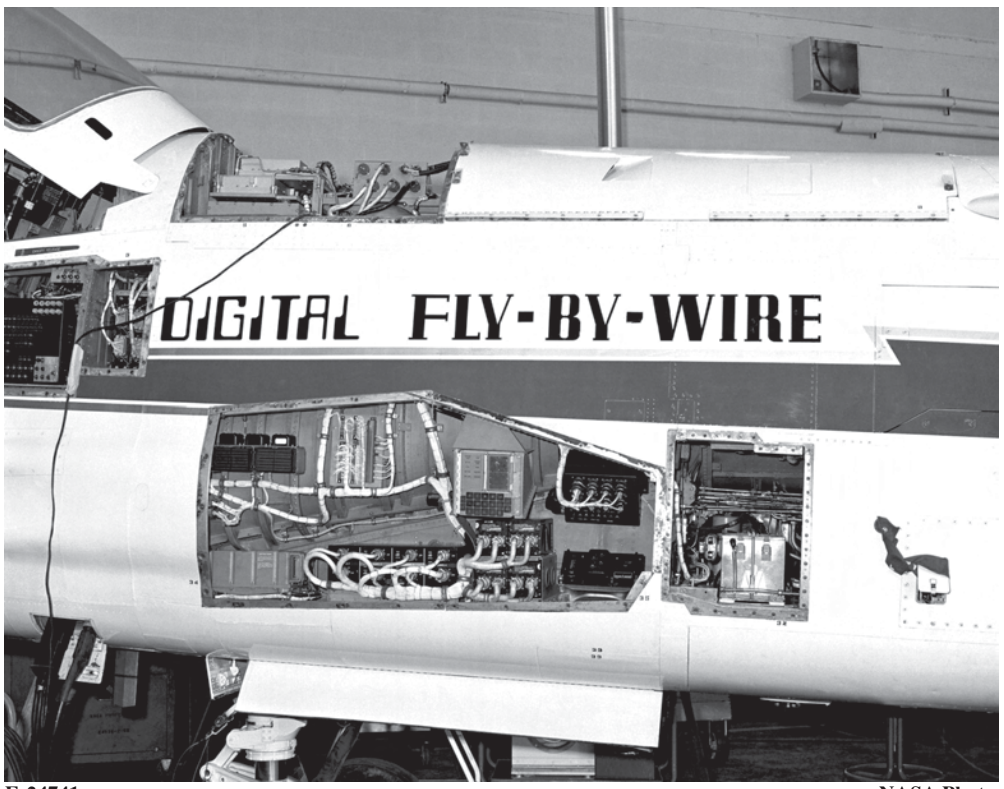
EC02 076-25 NASA Photo by Tom Tschida

This year's challenge can best be described as two-on-two robot basketball-football, where robots attempt to load 40 soccer balls into three movable goals, which are then pushed and pulled into various scoring zones for each team. After two minutes, the power is cut to the field, and points are awarded for robot location, goal location, and balls in the goals. The winning team is awarded three times the score of the losing team, so the trick is to keep your opponents' point tally as close behind yours as possible. This makes for more interesting matches, but it also requires teams to make certain design choices. The Lancaster team decided that control of the points would require controlling the goal position and little else. The previous year's robot had suffered from mediocre multitasking, and the students wanted this year's design to excel at a specific task: getting to the goals first and holding them.

Oompa-Loompa is a three-by two-and-a-half by two-foot tall box made from one-and-a-half-inch 7075 angle extrusion riddled with one long Saturday's worth of lightening holes. For those who are starting to turn the page, it is, in short, a tank. Its safety features include two pneumatically powered arms, which lash out at goal pole level, conveniently located near shin level. On the tips of these arms are foot-long caribeeners, which lock onto the goals in such a way as to force enemy robots to spend a great deal of time and energy extracting Oompa-Loompa's arms from the goal.

See Robotics, page 12

The F-8 Digital-Fly-By Wire aircraft flies one of its research missions. The project involving this aircraft contributed significantly to the flight control system on the space shuttles by tes AP-101 used on the shuttles and by helping the Dryden Flight Research Center to develop a pilot-induced oscillation (PIO) suppression filter that reduced the likelihood of pilots overc thereby creating excursions from the intended landing path.



E-24741 **NASA Photo**

The Apollo hardware in the F-8C is partially visible in the avionics bay at the top of the fuselage behind the cockpit. Note the display and keyboard unit in the area that formerly was the aircraft gun and ammunition bay.

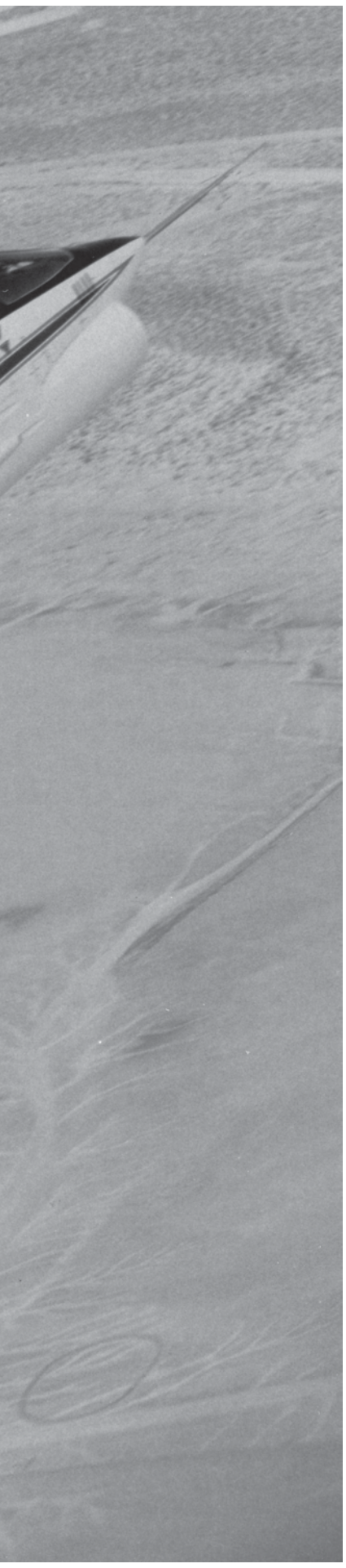
Digital Fly-
It's what's on the

■ May marked the 30th Anniversary of the F-8 Digital Fly-By-Wire first flight that revolutionized aircraft controls

By Curtis Peebles
History Office

At 8:14 a.m. on May 25, 1972, an F-8C began its take off roll down runway 04. As NASA research pilot Gary Krier lifted the plane into the air, there were no outward signs to indicate the significance of the flight. Other than the white paint finish and the blue lightning bolt down the airplane's side, there were no external differences with a standard F-8 fighter. The differences were all internal, and made this F-8 one of the most significant research aircraft ever conceived by the NACA or NASA. The F-8 flown by Krier was equipped with a digital fly-by-wire-control system, a feature that ultimately transformed aircraft design.

For the seven decades after the Wright brothers first flew, aircraft control systems were limited by human reflexes. The aircraft itself had to be inherently stable enough for



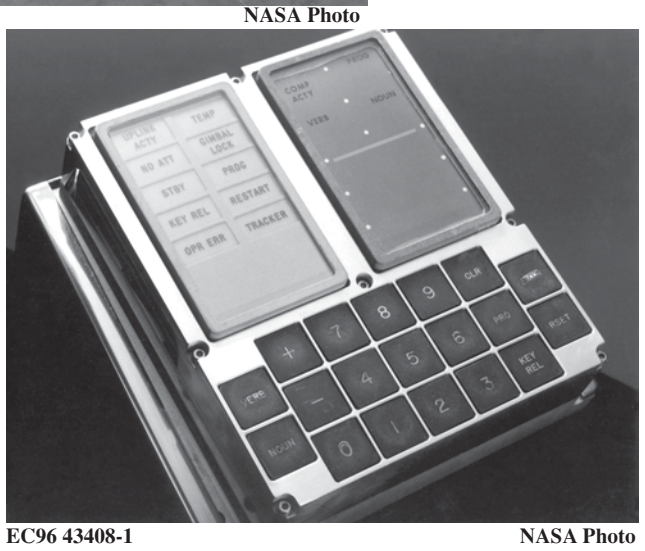
ting and getting the bugs out of the IBM controlling the shuttles on landings and

ECN 3091

EC85 33111-2 NASA Photo

Some F-8 Digital Fly-By-Wire team members included, from left to right, Ken Szalai, Wilton Lock, Bill Peterson, Jim Phelps, Jim Craft, Leo Lett, Dwain Deets and Cal Jarvis. Current Center Director Kevin L. Petersen worked on the program as a research engineer.

***At left**, flight research pilot Gary E. Krier with the F-8 DFBW.*



EC96 43408-1 NASA Photo

***Above**, this is the Apollo computer interface box used in the F-8 Digital Fly-By-Wire Program.*

By-Wire
inside that counts

a human pilot to keep it under control. The electronic system developed during this period, such as autopilots, dampers, and stability augmentation systems, made the pilot's task easier, but did not eliminate the need for inherent stability. Starting in the early 1960s, however, the Air Force experimented with "fly-by-wire" control systems, in which analog computers and electronic systems replaced the existing hydraulic controls.

During 1970, engineers at Dryden considered testing a digital fly-by-wire control system. With digital computers, any changes in the control laws were easily programmed into the computer. This was in contrast to analog computers, whose programs are physically wired into the system. The weakness of digital computers was that errors could easily slip into the program, and were hard to detect. A more pressing problem, however, was the lack of a digital computer that met the size, weight, reliability and power requirements for use in an aircraft.

The digital computer selected was the DSKY (Display and Keyboard Unit) computer, on the recommendation of Neil A. Armstrong, then a deputy assistant administrator for Aeronautics at NASA Headquarters and a supporter of the program. Armstrong knew it well; it was flown aboard the Apollo missions, and its reliability was unquestioned. The Charles S. Draper Laboratory of Cambridge, Mass., which had developed the DSKY brought a decade of experience to the digital-fly-by wire program. The technological and human capability was a direct transfer from the Apollo program to the aeronautical side of NASA, yet the digital fly-by-wire program was not very expensive. Initial funding was only $1 million for the first year, and it cost roughly $12 million in total. Costs were further cut when Adm. Forrest S. Petersen, the former Navy X-15 pilot, arranged the transfer to NASA of four F-8s scheduled to be scrapped. One became the F-8 Digital-Fly-By Wire aircraft; another became the "Iron Bird," used to ground test the computer and software; the third was the pilot trainer; the fourth was used in the F-8 Supercritical Wing program.

To keep costs and unknowns to a minimum, the DSKY hardware would remain unchanged, with only new software being written by Draper Laboratory. The same was true of the F-8. No aerodynamic and structural changes were made, and the aircraft's handling was to remain the same. The fly-by-wire system would be "transparent." At the same time, a bold NASA decision played a major role in the later acceptance of fly by wire technology. The Air Force had flown its analog fly-by-wire system with a standard mechanical back-up. On the NASA F-8, the primary system was the digital DSKY, backed up by an analog computer. By eliminating any mechanical redundancy, the engineers had no choice but to deal with the consequences of a fully fly-by-wire aircraft.

Between the start of the F-8 Digital Fly-By-Wire program in early 1971 and the first flight in May of the following year, a great amount of work had to be done. The DSKY, designed for the Apollo spacecraft, had a maximum roll rate of 70 degrees per second, significantly less than that of a fighter aircraft. The DSKY was also designed for a hand controller that used discrete steps, rather than the smooth motion of an aircraft stick.

See DFBW, page 12

DC-8 participates in water vapor study

By Beth Hagenauer
Aerospace Projects Writer

NASA's DC-8, based at Dryden, participated in a study of water vapor that feeds showers and thunderstorms. The aircraft was one of six taking samples during the International H_2O Project (IHOP2002) May 13 through June 14. Missions flew out of Oklahoma City's Will Rogers World Airport.

The National Center for Atmospheric Research (NCAR) led the large investigation of the moisture that produces heavy rains across the southern Great Plains from Texas to Kansas. Scientists hope the IHOP2002 measurements will answer questions about when, where and how summertime storms form and allow for better prediction of rainfall amounts from these storms. Improved forecasting of heavy rains may also result in more accurate flash flood warnings that could save lives.

Scientists from NASA Langley Research Center, Hampton, Va., operated a Lidar Atmospheric Sensing Experiment (LASE) installed on the DC-8 for IHOP2002. The LASE system is used to obtain high-resolution observations. It measures water vapor, clouds and aerosols by comparing the absorption and scattering of different laser pulses from the DC-8. Laser beams are emitted from the aircraft above and below to take measurements from near the surface to several miles above the aircraft.

Ed Browell, LASE principal investigator, said, "All the LASE water vapor, aerosol and cloud data will be used by atmospheric researchers for improving our ability to forecast the onset of strong storms and rain events."

Also aboard the aircraft were the University of Wisconsin's Scanning High Resolution Interferometer Sounder, which obtains a profile of the vertical distribution of moisture in the air. A third instrument from Goodrich Avionics Systems, Grand Rapids, Mich., sponsored by NASA Dryden, was a Clear Air Turbulence Scanner (CATScan). This instrument used an existing Stormscope antenna on the DC-8 to detect the signals generated by clear air turbulence.

The National Science Foundation, NCAR's sponsor, was the primary financial supporter of IHOP2002. Additional support was provided by other agencies including National Oceanic and Atmospheric Administration and Department of Energy.

The Search for Vulcanoids

■ Vulcanoids are not part of a Star Trek sequel, but can solve an old mystery

By Alan Brown
Public Affairs Specialist

Southwest Research Institute (SwRI), in collaboration with Dryden, has begun an innovative high-altitude observation program to search for a long-sought population of diminutive asteroids that may be circling near the sun in the innermost frontier of the solar system.

Called "vulcanoids" after the Roman god of fire and metallurgy, this hypothesized population of small asteroids is exceedingly difficult to observe from the ground because they orbit so near the sun. Researchers have made previous ground-based searches for vulcanoids during total solar eclipses, during the brief twilight period after sunset before the vulcanoids themselves set, and just before sunrise after the vulcanoids have peaked above the horizon. So far, those observations have succeeded only in placing limits on how many vulcanoids might exist, with no vulcanoids yet found.

SwRI theoretical models suggest that a modest population of a few hundred kilometer-size and larger vulcanoids could have survived the harsh dynamic environment of the solar system, far interior to the orbit of the planet Mercury, from primordial times to the present. The relative faintness of the vulcanoids against a twilight sky, along with atmospheric hazes and turbulence, have restricted ground-based searches to fairly bright limiting magnitudes corresponding to objects at least 12 to 37 miles (20–60 kilometers) across.

During the three-flight observation campaign, two SwRI astronomers took a sophisticated digital imaging system, the Southwest Universal Imaging System – Airborne (SWUIS-A), into the stratosphere in a high-performance F/A-18 jet aircraft used by Dryden to support flight research missions. This was the first phase of two observation series this year, with the second scheduled about the time of the autumnal equinox.

EC96 43830-11 NASA Photo
An aircraft like this F-18B was used in the quest for vulcanoids.

"Our vulcanoids search program, conducted from an altitude of 49,000 feet over the Mojave Desert, gave us a view of the twilight sky near the sun that is far darker and clearer than can be obtained from the ground," said principal investigator Dr. Daniel D. Durda, a senior research scientist in the SwRI Space Studies Department in Boulder, Colo.

"Our observations with the SWUIS-A imaging system will result in the most comprehensive, constraining search yet conducted for these objects," added co-investigator Dr. Alan Stern, director of the SwRI Space Studies Department. "SWUIS-A is a versatile and capable, low-cost astronomical imaging system developed by SwRI that operates in the broadband visible light and near-infrared spectrums. It has been successfully flown since 1997 in cooperation with NASA Johnson Space Center, Houston, Texas, and Dryden. Another version was flown on two space shuttle missions during the late 1990s, focusing on cometary, lunar and planetary observations in the ultraviolet regions of the spectrum."

NASA research pilot Rick Searfoss, a former Space Shuttle astronaut and Dryden's project manager for this year's airborne astronomy missions, said the opportunity to fly SwRI's SWUIS-A instrument on one of Dryden's two-seat F/A-18B aircraft is a unique win-win project.

"In employing high-performance operational aerospace vehicles like a space shuttle orbiter or F/A-18 Hornet, sensors and telescopes aboard the

See Vulcanoids, page 9

F-15 No. 837 to begin IFCS risk reduction flight series

By Alan Brown
Public Affairs Specialist

Dryden's highly modified NF-15B testbed aircraft No. 837 is getting ready to begin a second series of flights this summer in the next phase of the Intelligent Flight Control Systems (IFCS) research project.

These IFCS flights are being flown to reduce risk for two sets of research missions scheduled for next year. They will focus on calibration of newly-installed instrumentation and air data systems that are intended to provide better measurement data, as well as refinement of the parameter identification/estimation algorithm, which requires accurate measurements of the inputs and the response of the aircraft.

IFCS is designed to incorporate self-learning neural network concepts into flight control software to enable a pilot to maintain control and safely land an aircraft that has suffered a major systems failure or combat damage.

Flight evaluation of first- and second-generation self-learning neural network control software is expected to occur in 2003. Preliminary flight tests of an IFCS neural network that was pre-trained to the NF-15B's aerodynamic database were flown in spring 1999.

Dryden's NF-15B No. 837 last research role was in the Advanced Control Technology for Integrated Vehicles (ACTIVE) project, which concluded in 1999. In addition to its distinctive red, white and blue paint scheme, the aircraft is distinguished by its close-coupled canards mounted on the engine inlets just ahead of the wing and by its 360-degree thrust-vectoring engine exhaust nozzles.

Helios energy storage system makes the grade

By Alan Brown
Public Affairs Specialist

In a major breakthrough which met a NASA performance requirement, engineers from AeroVironment, Inc., and NASA have successfully completed functional tests of a prototype re-generative energy storage system for the Helios Prototype solar-powered aircraft.

The prototype system, housed within a pod that is designed to replace one of the existing landing gear pods, contains a hydrogen-oxygen regenerative fuel cell system that could be used to power the Helios aircraft through the night in future flight demonstrations. The energy storage system is the crucial element required to enable a solar-powered aircraft to fly longer than a single day and potentially for unlimited duration.

The energy storage system is based on proton exchange membrane (also known as polymer electrolyte membrane) fuel cell technology now rapidly emerging in automotive applications. The system is designed to capture excess electric power produced by the Helios Prototype's solar arrays during daytime flight and use it to electrolyze water into its constituent gases, hydrogen and oxygen. These gases would be stored under pressure and recombined in a fuel cell, producing electricity as a byproduct to enable night flight.

The recently completed tests, conducted at National Technical Systems in Saugus, Calif., climaxed more than two years of development work and demonstrated the viability of a flight-configured, hydrogen-oxygen aerospace regenerative fuel cell energy storage system. During the simulated day portion of the test, the prototype system absorbed 16 kilowatts of electrical energy for a period of about 5.5 hours until the storage tanks were fully charged by the electrolyzer. During the simulated night phase of testing, gas was discharged from the tanks over a period of about five hours into the fuel cell stack, producing up to 4.6 kW.

The prototype tests were conducted at sea level conditions with a system that, although not yet as light as will be required for flight on the Helios Prototype, has the essential attributes to fulfill the form, fit and function requirements of a flightworthy energy storage system.

"The significance of this system cannot be overstated," said John Del Frate, solar aircraft project manager at Dryden. "A flight-weight energy storage system not only gives Helios the ability to fly through the night, but eventually the capability to fly continuously as a stratospheric platform with its duration limited only by the reliability of onboard systems."

"The Helios project office believes this may be the first demonstration of a portable high power regenerative energy storage device based on environmentally

See System, page 12

Computers for kids

By Jay Levine
X-Press Editor

When Joe Meuret and John Morris came to Dryden for a boost for their technology education programs at Washington Irving Middle School, they had hoped to pick up a dozen computers, some printers and a few image scanners.

What they left with was even more impressive than they could have hoped for – it was similar to walking into an electronics store and saying "load me up" to the sales clerk. The difference is it didn't cost the Los Angeles Unified School District middle school more than a few phone calls and a few tanks of gas to upgrade their school.

Meuret, the middle school technology chairman, and Morris, an educator and technology committee member said they easily obtained more than $25,000 in computer equipment during a past visit to Dryden. And with the equipment they were back to collect, they said the impact would be great for students.

"Now we will have a computer in every classroom and some of what we acquired will allow us to completed five 'smart classrooms,' where there are nine computers," Morris said.

"I like the Computers for Learning Program because it allows us to get expensive computers we can't afford and it allows for technology for teachers in the classroom," Meuret added.

To facilitate schools like Washington Irving and other disadvantaged schools throughout the western region, Dryden brought back a long-time Center employee in December 2001 to connect the dots between the schools that need computers and those computers and electronic equipment for which the Center is trying to find new homes.

Patricia Smalling-Patton, an employee of Kay and Associates, Inc., has worked at Dryden for 22 years at several jobs, but none as rewarding as helping schools find the tools they need to educate students.

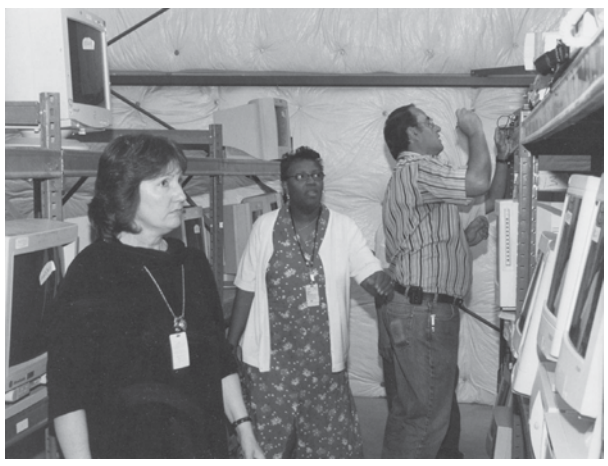
The federal Computers for Learning Program provides a way for schools that cannot get technology into the classroom to use federal and state computers and electronics that are no longer required. Even though the computers might not be usable to the agencies that are parting with them, it is many times a huge boost to schools that might have a limited number of computers or none at all, said Smalling-Patton.

Dryden Property Manager Jean Manning said all of the NASA Centers are a part of the Computers for Learning program, but it has been hard for Dryden to research needy schools and get the electronic equipment where it was needed before Smalling-Patton was hired in December 2001.

"Some schools in some areas didn't have computers and were not aware of the program," Manning said.

EC02 117-7 **NASA Photo by Tom Tschida**

Joe Meuret, left, and John Morris, second from right came to Dryden to find computer equipment for their school, Washington Irving Middle School in Los Angeles. Dryden is part of a government program to give computers that the government is replacing to schools that need the equipment. Assisting Meuret and Morris are Renato Pastor, SCSC, second from left; Patricia Smalling-Patton, Kay and Associates; Wilbert Brewer, SCSC; Carol Orr, SCSC; William (Bill) Wertman, SCSC; and Jennifer Hinkley, Infinity.



EC02 117-7 **NASA Photo by Tom Tschida**

Smalling-Patton, Property Manager Jean Manning and Wertman help locate addition equipment needs.

How successful is the program now that Dryden has a dedicated person onboard? From March to May 1,265 items were awarded to schools with a total value in excess of $2 million.

Although Patton-Smalling doesn't like to take credit for helping these schools, she does admit, "this job requires a lot of research."

Schools join the program online and are selected on the basis of their needs. Some people are not honest in the applications and it's Smalling-Patton's job to research who has a need and who does not.

She begins by looking at their request and then asks questions about what the school is seeking to accomplish to determine if there is other electronic equipment – such as printers, routers or other needs – that Dryden has to help the schools achieve their goals and give students a leg up.

Even the men from the Washington Irving Middle School were unaware of all of the items available to them and left with some monitors and lap tops to bridge another gap in the school's needs to complete its systems.

"I tell schools to bring a big truck," Smalling-Patton said.

Dryden also has assisted schools in Palmdale, Littlerock, Lancaster, Mojave and Tehachapi. Equipment has been secured for schools in California, Oregon and Arizona.

Even broken computers have value for the right school.

"Some schools take these older computers that don't work so they can take it apart and put it back together as part of their technology program. Even the old, old computers are not wasted. How great is that?" Smalling-Patton said.

Thank you, Dryden

Schools that have received computers from Dryden as part of the Computers for Learning program have found success and are enthusiastic about Dryden's contributions. Here are two examples:

Joseph Petito of the Torrance Unified School District wrote – "It is difficult to put down in a letter how much we appreciate and are thankful for the computers that your program has donated to us ... With what you have given us, we will upgrade what we have by a very large step.We could not have purchased anything close to what we have been given by you...In a few years, NASA will need another generation of engineers, technicians, service people, administrators, and scientists for your space operations. Where will they come from? They will come from us, the teachers of today, and we will teach by means of what you have given us – you, in effect, are planting the seeds for your own next crop of technological advancement. It grows even now before the computers you donated to us."

John Rivera, a former technology resource coordinator for the Annadale Elementary School in Los Angeles wrote: "The teachers and students are very excited about the computers donated to us. Our library did not have any computers before last Friday. With your donation, our school now has a multimedia library allowing students to conduct research on the Internet. The fact that the computers you donated already had NIC cards (Ethernet ports) allowed us to finally have machines that have the ability to take full advantage of our fiber optic network. "

Vulcanoids ... from page 8

vehicles can obtain better data than equivalent ground-based systems," he said. "While space shuttle-based astronomy missions have produced phenomenal results, any space mission is a very expensive and difficult undertaking.

"This small airborne astronomy project is being done at absolutely no additional cost to NASA or the public," Searfoss added. "Our research pilots must fly a certain number of night flights anyway for our proficiency requirements, but in working with SwRI, we can also contribute to an exciting pure research goal. It's the perfect blend of science and flight operations."

The vulcanoids zone is one of the few dynamically stable niches of the solar system that remains largely unexplored. Researchers believe this presumed reservoir of small objects could contain a sample of planet-building material left over from the earliest days of the inner solar system. Because of the intense thermal conditions and comparatively harsh collisional environment characteristic of this region, the vulcanoids population also might contain unique mineral assemblages not seen in other populations farther from the sun, such as asteroids and comets. In addition, because vulcanoids would impact and crater Mercury yet spare nearby bodies, knowing how many vulcanoids may exist will aid researchers' understanding of that planet's surface chronology and the impact history of the other planets in the inner solar system, including Earth.

This innovative asteroid observation program is funded by grants from the NASA Planetary Astronomy Program, the National Geographic Society, the American Astronomical Society, and the Fund for Astrophysical Research, Inc.

X-45 ... from page 1

looking for a place in 1999 and they were looking for a place to fly and receive technical assistance," Cosentino said.

Areas of support

The X-45A is different from most aircraft, which have a pilot in the cockpit or a remote pilot on the ground, because it is programmed to autonomously move from the hangar to the sky, said Lou Lintereur, a Dryden control system engineer.

"This vehicle does everything automatically. Autonomous controls are not commonly designed for ground operations. The aircraft is also unstable at takeoff and landing. We not only have to follow the mission plan, but we also have to stabilize the vehicle," Lintereur said.

Lintereur became involved with the project when Boeing requested that NASA design the ground control system for the vehicle.

"We designed the control laws for all weight on wheels conditions, whether it's taxi, takeoff, or landing, he said of his team's UCAV work.

"Our design depended heavily on the simulation models. Even though we built in good margins, it was a relief to see the taxi tests behave as the sim predicted," Lintereur said.

This test experience reinforced their faith in the design tools.

He mentioned his team, which includes Cheng Moua and Valerie Gordon, has met all their goals on the project. During future flights his team will evaluate the robustness of the control system in flight.

Cosentino also identified Greg Noffz and Mark Smith as two other members of the Dryden team who have contributed with their knowledge of aerodynamics.

Gordon, an aerospace engineer, explained her initial work in developing the UCAV's vehicle performance and health monitoring system by working with Boeing's St. Louis Phantom Works. She worked with them on identifying parameters that should be monitored during ground operations to ensure safety.

"It will react autonomously to make a mission as safe as possible," she said.

For example, it has a return to base mode, where if the vehicle experiences specific failures, it will return to base. Monitors also have been established to alert the UCAV operator if certain unfavorable conditions exist that could lead to failures in major systems, Gordon said.

Starr Potter, a mechanical engineer, designed a soft support system, a way to suspend an aircraft and make it think it is not connected to the ground, to assist her in the ground vibration test (GVT) conducted in January 2001. This is an elaborate test fixture for its type that is capable of suspending aircraft up to 14,000 pounds.

The ground vibration test (GVT) was conducted to measure the aircraft's structural modes in order to update the analytical model and calculate the vehicle's flutter margin. The X-45A GVT was one of the largest conducted at Dryden. And because of her familiarity with the X-45A's structure, Potter was asked to do further work and help support the vehicle's flight test.

Potter also assisted with other research, structural mode interaction (SMI) tests and will use Dryden's new test fixture and capabilities on the X-45A Vehicle No. 2.

EC01 300-7 NASA Photo by Tony Landis

Dryden assists the Boeing Company on the UCAV X-45A. Here, a Boeing T-33 flies X-45A software. Dryden pilot Dana Purifoy assists as the pilot for this mission. Dryden's Marty Trout also supports some T-33 flights as the backseat engineer.

UCAV's future

Vehicle No. 1 arrived at Dryden on Nov. 8, 2000, and Vehicle No. 2 arrived on May 15, 2001. Eight more flights are planned for Vehicle No. 1 to expand the flight envelope prior to the first flight of Vehicle No. 2. The second UCAV is undergoing final assembly at Dryden and engine start on that vehicle is expected this summer.

Dryden's role is expected to continue. A recently signed extension has Dryden committed to UCAV support through September 2003. However, it is possible that Dryden's role in X-45A will extend until 2004 when the demonstration phase of the project is expected to be complete, Cosentino said.

X-45B models, which are expected to be about one-third larger, will shift for flight research and tests to the Air Force. However, Dryden is expected to remain a partner in researching the aircraft.

Risk reduction

Dryden also has assisted with a Boeing T-33 that operates as a surrogate for the X-45A to enhance safety and identify challenges early in the flight research phase. Dryden augments Boeing's staff to fly the T-33. Dana Purifoy is one of the pilots and Marty Trout is qualified to fly in the backseat.

"Before the X-45A flew its first mission, the T-33 carried the vehicle management system computers, which contain the GPS and other components necessary to fly the mission plan. The T-33 flew the mission profile on autopilot to validate the mission plans and train team members. Each mission is rehearsed with the T-33 first. The T-33 mission profiles train not only the team, but also the support personnel and Range Safety Officer. They can track the T-33 like it was the X-45A," Cosentino said.

The T-33 is a risk reduction tool that will have other roles with the X-45A Program.

"The T-33 can fly with the X-45A and act as a second UCAV," Cosentino said. "We can fly UCAV demonstration flights with the T-33 and X-45A. The T-33 can allow us to integrate with a manned aircraft for the first time. The T-33 allows us to dry run a lot of things. Once we're sure its correct, we can fly it on the X-45A Vehicle No. 2."

Remaining flight control systems, and we're looking forward to flight testing."

AAW ... from page 3

"This aircraft and this technology is the first research stepping stone to dramatically improved performance and safety that NASA intends to pursue for the 21st century aircraft," said Denis Bessette, project manager for AAW flight research at Dryden.

"Active Aeroelastic Wing returns aeronautics to its beginnings, and opens the way to new avenues of lifting surface research in the future," added Ed Pendleton, Active Aeroelastic Wing program manager for the Air Force Research Laboratory, Wright-Patterson Air Force Base, Ohio.

The test aircraft – an F/A-18A obtained from the U.S. Navy – has been modified with additional actuators, a split leading edge flap and thinner wing skins that will allow the outer wing panels to twist up to five degrees. The traditional wing control surfaces – trailing edge ailerons and the outboard leading edge flaps – are used to provide the aerodynamic force needed to twist or "warp" the wing. Project engineers hope to obtain almost equivalent roll performance of production F/A-18s at transonic and supersonic speeds without deflecting the horizontal tail and with smaller control surface movements.

The most extensive loads testing ever performed in Dryden's Flight Dynamics Laboratory was conducted last year on the F/A-18's modified wings. The six-month structural loads effort included wing twist or torsional testing and extensive loads calibration testing at up to 70 percent of the design limit load of the airplane, with load distribution over the wings a particularly critical item.

EC02 61-2 NASA Photo by Tom Tschida

NASA aircraft technician Donte Warren places the first official Centennial of Flight Commission logo on an aircraft, Dryden's Active Aeroelastic Wing (AAW) F/A-18.

Following ground vibration tests and various checkout procedures, the two-phase AAW flight test program is slated to begin with parameter identification flights this summer. Boeing's Phantom Works will use data obtained from the first series of flights to refine wing effectiveness models and design the AAW flight control laws. The second phase of research flights to demonstrate the AAW concept with effective control laws should take place in 2003, almost 100 years after the Wright brothers' first powered flight on Dec. 17, 1903.

Boeing Phantom works in St. Louis, Mo., modified the F/A-18's wings and is developing the active aeroelastic wing flight control software.

"We understood the challenge, drew on talent from across Boeing and the AAW program partners, and then applied that technical expertise to achieve results," said Jim Guffey, AAW program manager for Boeing Phantom Works. "We consider the AAW project a

The official Centennial of Flight logo was on the AAW aircraft during the rollout ceremonies.

"This logo honors the Wrights' accomplishments and the contributions of others whose vision, persistence and ingenuity have taken us from the sand dunes of North Carolina's outer banks to the surface of the moon and a permanent presence in space," said Debbie Gallaway, assistant director for programs at the U.S. Centennial of Flight Commission. "The history of aviation and aerospace is a story about individuals from around the world whose ability to dream of flight was only surpassed by their ability to make it happen. Their efforts revolutionized our world."

The U.S. Congress created the Centennial of Flight Commission in 1999 to serve as a national and international source of information about activities to commemorate the centennial of the Wright brothers' first powered flight on the sands of Kitty Hawk, N.C. Centennial activities are scheduled for 2003 in both North Carolina and Dayton, Ohio, home of the Wrights.

One of several Wright Flyer replicas is slated to fly at Dryden in 2003. In addition to these celebrations, numerous historical and educational projects are anticipated on the subject of aviation and aeronautics that will be an important legacy of the centennial of powered flight.

EC02 115-1 NASA Photo by Tom Tschida

Dryden's Shuttle and Aircraft Support Services (SASS) Team won one of its company's biggest awards for supporting two Space Shuttle landings in 2001 and for general excellence in its work operations.

Top Flight

Dryden team brings home its company's biggest of honors

By Jay Levine
X-Press Editor

When Space Shuttle Endeavour landed at Dryden on June 19, it was with skill and confidence that the Dryden Team responded to the challenge.

Part of that Dryden team is Enterprise Solutions' Shuttle and Aircraft Support Services (SASS) Team, who is an arm of Lockheed Martin Space Operations. The team recently was recognized with the company's highest honors – The Top Flight Award – for supporting two similar missions in 2001 and for Space Shuttle support services.

The award is given to just a handful of Lockheed Martin groups and individuals each year. The Dryden group was recognized for handling two Space Shuttle Landings at Dryden including the flawless Feb. 20, 2001, landing of Space Shuttle Atlantis and the May 1, 2001, arrival of Endeavour. The group also was recognized for improvements to Dryden facilities to allow for the most efficient processing of potentially critical Space Shuttle batteries and tools.

The award originally was given at a special ceremony in Texas, but several Lockheed officials came for a special barbecue and ceremony at the Shuttle Area A in May. Employees were individually thanked for their contributions to the Space Shuttle efforts at Dryden with certificates and glass trophies recognizing their work.

Dryden was the primary landing site for the Space Shuttles early in the program, but now landings here are uncommon. However, Dryden teams remain sharp and ever ready for the possibility that a Space Shuttle could land here. For that reason, Lockheed was impressed with the Dryden workers who flawlessly performed their jobs during the two Shuttle landings.

"We are tremendously proud to be able to reward this group. After four years without a Shuttle landing to be able to respond to two landings back to back flawlessly is huge. This is a difficult award to win, and the competition is tough. The team also can display the Crystal Eagle that honors their win," said Ted Bilke, vice president of Enterprise Solutions.

In addition to the landing support, the team also was recognized for its Aeronautical Energy Systems Laboratory, or battery lab, that was renovated with updated equipment to more efficiently build and charge batteries for Dryden's aircraft. And the team also was recognized for its Precision Measurement Electronic Laboratory, or calibration lab, where the team had aggressively reduced a list of overdue tasks from 400 to 30.

"I am proud of all the hard work this team did to earn the award. They are always looking to improve and are very dedicated to their tasks," said Lance Dykhoff, Shuttle and Aircraft Support Services program manager.

Two members of the Lockheed contingent – A.J. Christiansen and Dykhoff – also were recognized for 20 years service, even though the contract has been held by several companies as mergers consolidated the aerospace business during that time.

Team members include Roberto Arellano, Irvin Armstrong, Kwame Bailey, Bruce Barcus, Chris Begg, Paul Bellinger, John Booksha, Betsy Booth, Christiansen, Gerald Dow, Dykhoff, Richard Elliot, George Ellis, Harry Galloway, William Gemike, Arnaldo Gonzalez, Barry Hileman, Fred Johnson, and Shirley King,

Also on the team are Pamela Mathews, Heidy Molina, William Moon, Ray Mowery, Max Moyer, Martin Munday, Vicki Nault, Priscilla Neal, Andrew Olvera, Thomas Percival, David Plummer, Christine Putnam, Jose Rivera, David Rush, John Sammons, Juan Santos, Roy Torrez, Gene Willard, and Robert Zencka.

Award ... from page 1

The Administrator's Award is bestowed to projects that exceed NASA's visions and goals and is not an annual award. The team was recognized for the Helios Prototype record altitude flight last summer of 96, 863 feet.

John Del Frate, Dryden's solar-power aircraft manager and Bob Curtin, Helios Prototype aircraft builder AeroVironment's Vice President, each accepted a separate trophy to take back to their organizations. Also on stage with Del Frate and Curtin was Bill Parks, AeroVironment chief engineer on the Helios Prototype.

Del Frate likened the event to the Academy Awards for NASA aeronautics, only without acceptance speeches.

"It was very humbling accepting the award. Our project was selected from a huge .organization that does such amazing work," he said.

Del Frate also explained the current Helios Prototype work and the difficulty level associated with that goal.

"Flying high was a huge aeronautical challenge which took years of hard work by a very talented team and I don't want to understate its significance. But our next step of making extreme endurance flights a reality may be an even bigger challenge. We're really motivated though as we believe the pay-offs are potentially huge," Del Frate said.

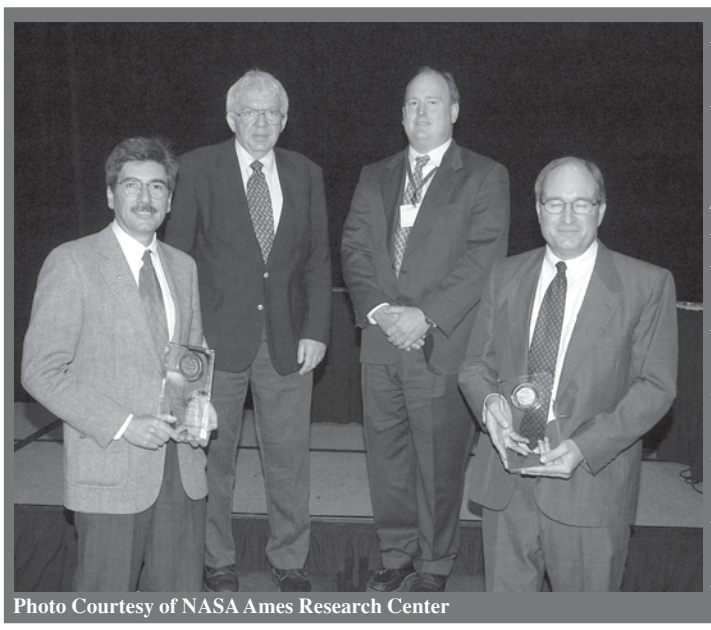


Photo Courtesy of NASA Ames Research Center

Aerospace Technology Associate Administrator Sam Venneri, second from left, presents the Administrator's Award to Dryden Solar Power Aircraft Manager John Del Frate and AeroVironment's Vice President Bob Curtin and the Helios Prototype Chief Engineer Bill Parks.

ERAST Program Manager Jeff Bauer said he is proud of the Helios Prototype Team.

"I am very pleased to see that the Helios team was selected for the NASA Administrator's Award. The team comprised of industry and government members serves a good example of how collectively we can accomplish great things. The success of the project is due to their hard work and the tireless efforts of those before them to establish a project philosophy and approach that resulted in maximum utilization of each participant's skills. It is gratifying to see the recognition for their efforts respected at the NASA Administrator level," Bauer, said.

And Dryden's partner thanked NASA for the opportunity to succeed.

"A team that is given a tough goal along with decision making freedom and adequate resources is very powerful. NASA created these conditions for the solar aircraft development team and enabled us to accomplish tough goals. We at AeroVironment consider ourselves fortunate and honored to be a key member of the team that was able to create the world's highest flying airplane," Curtin said.

Dryden's trophy will be displayed in the Center hallway glass case in Building 4800. The honor is made from solid Lucite and enscribed "Administrator's Award" in black letters.

Robotics ... from page 5

An aluminum base, which a pneumatic cylinder presses into the floor to lift Oompa-Loompa off of its wheels and render it unmovable, further thwarts the dark side. The four wheels are each powered by a separate motor through a chain drive. This gives a top speed of about five feet per second and a battery life of from five to ten minutes, depending on how much sugar the drivers had for breakfast. If you think all of this was calculated out beforehand, think again. Like all design, robot creation relies heavily on what worked before. This year, "Oompa-Loompa" was designed to correct the mistakes of last year's "Cledus," which was designed to correct the mistakes of the previous year's "Pac-Bot." An inspiring testimonial to where we've come from, the two veteran robots sat in a corner of the shop and watched as "Oompa-Loompa" took form.

How slowly it takes form becomes apparent at the beginning of the second two weeks, Manufacturing Phase. There is a wealth of great ideas, but not nearly enough on paper to satisfy those of us who push it for a living. As a mentor, the primary focus now is to get the kids to come up with the numbers to put into the design: the weight of the balls, the size of the goals, the number of goals, anything, any number, just give me a number!

At first, there are only a brave few who are willing to come up with numbers and use them in calculations. Then they begin to realize what took me until college to see: that engineering isn't magic. Little by little, I overheard kids talking about gear ratios, moment arms, and current draw. They become one with their safety glasses, which sometimes head home with them on the backs of their heads. The shop is a cacophony of a dozen students sawing wood, drilling lightening holes, bucking rivets, wiring motors, and endlessly filing aluminum.

This is when one realizes that they're working as fast as they can and the robot does not yet meet that time-honored criterion of MOVING! Then students started almost frantically putting together the essentials – the base, the wheel assemblies, the motor mounts, and whatever else they solidified in their design. The robot components flew together and after a few long weekends, it began to appear that they might make it. Then Oompa-Loompa was placed upon the scales for the first time and was found to be too close to the 130-pound limit.

Thus, students entered the final two-week Diet Phase, where Oompa-Loompa was disassembled in order to turn the concrete floor into a shiny, sharp aluminum carpet. Delicate electrical components were wrapped in cellophane. Thanks to a large, hard-working labor force, soon all the aluminum which could be removed had been transferred to the floor, and the single largest source of weight were the scores of quarter-inch steel fasteners holding Oompa-Loompa together. The arms appeared, and the pneumatics and electronics soon followed. The students all took ownership of the robot, and one could see their hard work, from the deployable base inspired by a "trick" auto security device to the caribeener arms, which no mentor even saw until they were practically ready to install. There was no time to assemble the final pieces: battery mounts, stiffeners, braces for the electronics board, and assorted fasteners. Those parts were shipped in the crate to be finished the day before competition.

April 4 to April 6 was the Southern California Regionals, with about 60 teams competing. The first day was spent unpacking the robots, getting them ready for competition, having them weighed, sized, and inspected. While the robots are dressed for the morrow, team members begin the politicking, networking, and marketing which veteran teams know is crucial to success in competition. Buttons, t-shirts, keychains, pens, stickers and candy change hands faster than the screwdrivers, socket wrenches, and, yes, even faster than the duct tape. Promotional videos, spec sheets, and anything that team members could write "Team #399" added much more recognition to the game where it paid to study both potential allies and opponents.

In competition, team spirit was not taken lightly. Team members saluted their metallic champions with robot suits, a score of synchronized blue and white flags, and a drum corps knocking out six hours straight of syncopation that put most of the DJ's beats to shame. Lancaster High School Eagle Robotics was represented by two 16-year-olds dressed up as Oompa-Loompas tossing super-saturated sugar candies into the crowd.

Nothing could prepare one for the sheer volume of teenage energy that poured into the Los Angeles Sports Arena at Regionals. The Techno blasted and the drum corps, screaming, chanting and tears rivaled a half-time show. The floor area was divided into the Game and the Pits. Joining the two was a ragged line of mechanical contraptions on dollies, tended by boys and girls whose safety-glassed eyes only occasionally looked up from the preparations on the way in or the repairs on the way out. All of the teams have uniforms. There were white lab coats, gray trenchcoats, tan overalls, cowboy hats, baseball caps, and every color T-shirt imaginable. Our team was easy to spot, outfitted in bright orange button-up jerseys, each displaying an often-unrequested nickname. Mine said GEE-WHIZ, my nickname having been bestowed early in my robotics career, before they found out that working for NASA doesn't make me a rocket scientist.

Our efforts paid off. Having demonstrated its rugged abilities in qualifying matches, Oompa-Loompa caught the notice of the second-ranked grouping, Cortez and Hawaii, who chose our little bruiser to be part of their triad to fight for the gold. Oompa-Loompa performed flawlessly in quarter and semifinals, with the help of driving that only the Nintendo generation could pull off.

The Finals gave Oompa-Loompa a chance to compete against the heavy hitters: teams Ford and GM, both robots were triumphs of engineering that make you wonder what BMW would have entered. In the end we lose to these titans, coming in a respectable second place. I am happy for them, but I am also relieved. In a way, watching our robot go up against the best that private industry has to offer makes me cringe. I know our gearboxes are not four-year veterans of these competitions, designed by teams of engineers with machine shops at their disposal. Ours consisted of bearings pressed into pieces of sheetmetal and shafts relying on friction and set screws to keep the wheels turning.

This year, we set our sights high, aiming for the most coveted of FIRST awards, the Chairman's Award, for the team that most embodies the spirit of FIRST. A unified team, community outreach, learning workshops, mentoring of other schools, and sportsmanship are the criteria. This is the third year that Lancaster High School participated in the FIRST Robotics competition, and the first time they have brought home a trophy from Regionals. As I left the event, I overheard some of them discussing how to correct the mistakes of Oompa-Loompa, so I know next year's creation is going to be even better.

System ... from page 8

friendly fuel cell technology," Del Frate commented. "The new technology demonstrates an energy storage density better than double the most advanced secondary battery systems yet devised.

"This lightweight portable regenerative energy storage technology can also be configured and scaled for non-aircraft applications," he added. "Some of those applications include NASA space exploration and planetary surface power, electric vehicles, and both fixed and portable solar power on Earth."

The completion of this effort successfully fulfilled a milestone established under NASA's Environmental Research Aircraft and Sensor Technology (ERAST) project, which is managed at NASA Dryden. The Helios Prototype met another ERAST milestone last August when it flew to an unofficial world altitude record for non-rocket-powered aircraft of 96,863 feet near Hawaii and maintained stable horizontal flight above 96,000 feet for more than 40 minutes.

The energy storage system design team was led by AeroVironment, with technical assistance from Dryden and NASA Glenn Research Center, Cleveland, Ohio.

DFBW ... from page 7

Adapting the Apollo computer to the F-8 joined two separate technological cultures. For the airplane culture of Dryden, it meant adapting to the demands of computer technology. For the software engineers, who had previously worked with missiles, it meant adapting to day-to-day operations of airplanes.

The first flight marked the start of Phase I, which lasted through November 1973, and involved a total of 42 flights. Research pilot Krier linked this stage to the Wright Flyer, in that it was the first full fly-by-wire aircraft. Even these early flights had an impact. They gave General Dynamics the confidence to install fly-by-wire at the start of the F-16 program. At the same time, the hand-crafted "single-string" DSKY was not practical as an operational system. Phase II used three IBM AP-101 computers linked together in a redundant network. This provided a robust, production-type system capable of handling in-flight glitches smoothly, with the reliability needed for normal operations. AP-101s were later installed on the Space Shuttle, and the Dryden F-8 team was able to provide invaluable support for the Shuttle. This included "de-bugging" the AP-101s, flying simulated landing tests, and testing the software filter developed following the pilot induced oscillation during the fifth Shuttle landing of the Approach and Landing Test program. Phase II, which lasted from August 1976 through December 1985 and involved 169 flights, also tested adaptive control laws, sensor management, use of a computer on the ground, and backup software.

Looking back after 30 years, it is clear that the F-8 Digital Fly-By-Wire aircraft fundamentally altered aviation technology. It showed that the concept was both possible and practical. It eliminated the need for inherent stability, which allowed designers to optimize an aircraft for its mission, knowing that the computers would keep the wings level. The use of fly by wire has spread from military fighters, such as the F-16, F-18, and F-117, to cargo planes and airliners. Finally, the advances in computer technology have allowed the concept to expand far beyond flight controls. For instance, using the concepts developed for the F-8, computers now routinely optimize engine performance, even on airliners without fly-by-wire systems.

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